4.8
Rapid Geophysical Surveyor

Figure 4.8

DESCRIPTION

The Rapid Geophysical Surveyor (RGS) is a passive, nonintrusive measurement system that automates the collection of high-spatial-resolution geophysical data. Closely spaced data are required to adequately characterize complex buried-waste areas commonly found in the Department of Energy, Department of Defense (DoD), and private sectors. The system measures and associates the local magnetic field with precision positioning in a systematic fashion. Variations in the Earth's local magnetic field are indicative of subsurface ferromagnetic material which is a common component of buried wastes.

The RGS consists of magnetic-field sensors, a calibrated measuring wheel, and a microprocessor-based data logger mounted on a hand-pushed, nonferrous vehicle. The data logger uses menu-driven software so that the key survey parameters can be configured by the user. The user pushes a 20 lb cart to collect magnetic data (see Figure 4.8). Magnetic data are automatically collected and stored at user-specified intervals as close as 2 in apart along survey profile lines. These data form a high-resolution database capable of locating individual objects and potentially determining object orientation, shape, and depth to burial. No input is required for this passive system, and the output of the RGS is a set of spatially correlated magnetic data.

TECHNICAL PERFORMANCE

Field Demonstration. The RGS was initially field tested in September 1992 at the Subsurface Disposal Area (SDA) at the Idaho National Engineering Laboratory (INEL). The system functioned so well that a production survey of the Pit 9 area within the SDA was performed with the prototype RGS in October 1992. Since then, the RGS has been used on many sites within the INEL and for outside agencies, including the DoD and the Environmental Protection Agency (EPA). The RGS was successfully used to locate waste trenches and pits, underground storage tanks, and underground utilities. It was used with success in isolated areas and in the proximity of buildings and above-ground utilities where magnetic noise is a concern for conventional magnetic instruments and surveys.

The RGS has demonstrated data-collection rates of up to 30,000 data points per hour compared to a maximum of about 200 data points per hour for baseline, handheld magnetometer technologies. Also, because the RGS automates data collection, errors caused by human fatigue are greatly reduced, improving field efficiency and overall accuracy. The RGS is a self-contained unit, drawing all power from a single 12 volt, 7 amp-hour gel cell battery that supports 8 hours of continuous operation before a battery recharge is required.

Cost. Survey cost with the RGS is proportional to site size and is essentially the man-hours required to perform the survey, as the capital investment in the equipment is very small. The initial development cost of the RGS was $80K. It is anticipated that the cost of a commercial version of the RGS would be well under $10K.

PROJECTED PERFORMANCE

Potential enhancements include the addition of a remote absolute positioning system that would preclude the use of the measuring wheel to track relative distance travelled by the RGS. A number of technologies have potential application, such as microwave interferometry, ultrasonics, optical techniques, and global-positioning systems.

APPLICABILITY

The RGS is applicable to all problems where ferromagnetic material is included in the waste search target. This includes waste pits and trenches in landfill scenarios and underwater applications. This concept can also be expanded to include other nonintrusive geophysical instruments such as electromagnetic devices.

STATUS

The RGS is commercially available to the private sector as a service through Sage Earth Science.

REGULATORY CONSIDERATIONS

Regulatory issues are expected to be minimal. Because this is a nonintrusive characterization technique, there is no subsurface disturbance or process waste, and little or no requirement for decontamination of equipment is anticipated. No health hazards originate from the RGS; however, exposure to hazardous materials at survey sites is possible. The RGS concept sets a new standard for geophysical surveys, and it is conceivable that this new standard may be incorporated into EPA standard practices for environmental surveys.

POTENTIAL COMMERCIAL APPLICATIONS

Expected commercial applications include underground storage-tank detection and location, pre-transaction real-estate environmental surveys, underground-utility location, and industrial-site environmental surveys.

BASELINE TECHNOLOGY

Handheld instrumentation represents the current method for collecting magnetic and electromagnetic geophysical data. Hand-positioned magnetometer surveys are labor-intensive. In contrast, the RGS can perform geophysical magnetic surveys more quickly (30 to 300 times faster) and more economically ($.25 versus $5 per datum point) than handheld instruments can. The RGS raises the standard for environmental surveys by providing the ability to collect spatially dense data sets at an affordable cost. To date, cost has been the primary concern and limitation when planning and budgeting environmental surveys, especially in the private sector.

INTELLECTUAL PROPERTY

A patent disclosure has been made.

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REFERENCE

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